(54) Title: MULTI-USER RETRO REFLECTOR DATA INPUT

(57) Abstract: The apparatus uses retro-reflected light, having a fixed component (41) and a variable component (37) varied by a person, from a retro reflector (31) connected to a person to input data (37A) to an information system (13) and does this for each of several persons in the same time interval.

TITLE

Multi-user Retro Reflector Data Input

BACKGROUND

The invention uses retro-reflected light having a fixed component and a

5 variable component varied by a person, from a retro reflector connected to a

person to input data to an information system and does this for each of several

persons in the same time interval.

Limits of data input via retro-reflected light - for example by Honey in U.

S. Patent 5,912,700 and by Stuart in U. S. Patent 4,998,441 - are surmounted by

10 the discovery shown here.

SUMMARY

Light retro-reflected by a retro reflector connected to a person has a fixed

component and a variable component and is detected by an imager which inputs

data to an information system.

15 Other forms and objects of the invention will be comprehended in the

drawings and description, which will make further equivalent forms and objects

obvious hereafter to persons skilled in the art.

DRAWINGS

FIG. **1** shows two users inputting data to an information system.

FIG. **2** shows light retro-reflected from a retro reflector in FIG. **1**.

FIG. **3** shows light retro-reflected from a sequent retro reflector in FIG. **1**.

FIG. **4** shows a retro reflector on a card.

FIG. **5** shows a finger acting as a retro reflector and retro reflector parts

on a cylinder.

DESCRIPTION

The data input apparatus is used with an information system indicated by

the display device **13** in FIG. **1**. The data input apparatus comprises an imager

indicated by a lens **11**, a light source indicated by a ring light **12**, and a retro

reflector indicated by a retro-reflecting disc **31** on a hand portion of a person.

Though the retro reflector is on the person in the example of FIG. **1**, the

retro reflector can be connected to the person in various ways such as by being

held by the person, by being on gear worn by the person, or by being on a device

- such as an aircraft - transporting the person. The meaning of "connected to a

person" here is distinct from connection by a signal.

Throughout use for data input, the retro reflector remains connected to the

person. This is distinct from the case where retro-reflecting material is attached

to an object - such as a thrown ball - which moves independently of the person.

Ideal retro-reflecting objects retro-reflect all incident light back coaxially

along the path of the incident light. Thus, an imager adjacent to the light source

will detect retro-reflected light - which is light from the light source retro-

reflected by the retro reflector to the imager - with a high signal to noise ratio

5   between the retro-reflected light and any other light detected by the imager. The

signal to noise ratio becomes greater and smaller as retro-reflecting objects are

more and less ideal.

"Adjacent" here means that the retro-reflected light is within the field of

view of the imager. A light beam from the source and the retro-reflected light

10   beam incident on the imager can be made precisely coaxial by using beam

splitting devices, and this also is included in the meaning of "adjacent" here.

"Detect" here means that the imager locates the retro reflected light

relative to the imager field of view - for example, as exposing specific pixels of

a charge coupled device.

15   The retro-reflected light has a fixed component indicated for example by

41 in FIG. **2** which depicts retro-reflected light seen by the imager. The retro-

reflected light also has a variable component which is varied by the person.

One example of the variable component is indicated by the path **37** along

which the person moves the retro reflector. Another example of the variable

20   component is indicated by a second retro reflector part **35** being first positioned

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to be seen **45** by the imager and later being positioned to be not visible to the imager.

A multiplicity of distinct variations of the variable component - comprising data - can be generated by the person varying positions of a retro

5   reflector and varying configurations of more than one retro reflector part. This meaning of a variable component is distinct from the case where a person moves a bar-coded object so that an imager can read the fixed bar code.

When, in a time interval, the imager detects the variable component, the imager inputs a signal to the information system.

10   In the example depicted in FIG. **1** a variable component corresponds to the series of positions making up the path **37**, and the sequent signal comprises data identifying the series of positions along the path **37** in the time interval.

Also in the example depicted in FIG. **1** a variable component is a start configuration of the retro reflector **31** and the second retro reflector part **35** at

15   the start of the path and is a stop configuration with the second retro reflector part obscured at the end of the path. The start configuration could be mapped by the imager as a start signal causing the information system to start **51** a trace **37A** corresponding to the path, and the stop configuration could be mapped by the imager as a stop signal causing the information system to stop **52** the trace

20   corresponding to the path.

Start and stop signals to start the trace and to stop the trace could also be

input by other means such as key strokes, mouse clicks, and speech.

The information system need not visually display the trace, as the trace

could be data used or stored by the information system. The trace could be in

5   three spatial dimensions, and in time, in data used or stored by the information

system. A second imager with light source, and more, could be used to help

generate three dimensional data. Also, a wand-like retro reflector with two distal

points separated by a known distance can be used to facilitate three dimensional

data.

10   When, in the time interval, the imager detects the fixed component, **41** for

example, the imager inputs an identity signal to the information system.

In the example depicted in FIG. **1** there is also a sequent retro reflector **61**

connected to a sequent person, and there is sequent retro-reflected light with a

sequent fixed component **71** depicted in FIG. **3**.

15   When, in the time interval, the imager detects the sequent fixed

component **71** the imager inputs a sequent identity signal to the information

system. The fixed components **41** and **71** are distinct, and thus the sequent

identity signal is distinct from the identity signal.

The sequent retro-reflected light also has a sequent variable component

20   varied by the sequent person. One example of the sequent variable component is

indicated by the path **67** along which the sequent person moves the sequent retro

reflector **61**. Another example of the sequent variable component is indicated by a sequent second retro reflector part **65** being first positioned to be seen **75** by the imager and later being positioned to be not visible to the imager.

When, in the time interval, the imager detects the sequent variable

5   component, the imager inputs a sequent signal to the information system.

In the example depicted in FIG. 1 a sequent variable component corresponds to a series of positions making up the sequent path **67**, and the sequent signal comprises data identifying the series of positions along the sequent path **67** in the time interval. The sequent signal can cause the

10   information to trace a path **67A**.

The retro reflector and the sequent retro reflector function interchangeably. The contents of the fixed component and the sequent fixed component are distinct. The contents of the variable component and the sequent variable component are varied by distinct persons and can be distinct.

15   An imager can distinguish retro-reflected light - **45** and **41** for example - retro-reflected by a person from retro-reflected light - **75** and **71** for example - retro-reflected by a sequent person because of the distinct fixed components and because distances between retro-reflected light retro-reflected by one person - **45** and **41** for example - are smaller than distances between retro-reflected light

20   retro-reflected light not retro-reflected from by one person - **45** and **75** for example.

While **71** is shown to have bar code like configurations, other properties - such as shape and color - can also be used alone and in combinations to comprise fixed components.

In FIG. **1** the retro reflector is shown as a retro-reflecting disc attached to finger tips. Retro-reflecting objects can be attached to each of the fingers and to other portions of a hand such as knuckles and to other portions of the body. Various commercial retro reflecting materials - utilizing micro spheres and embossments for example - produce very high signal to noise ratios and can be put on hand portions in various ways - such as with adhesive, with rings, and with thimble-like devices.

A retro reflector on a card **87** which can be held by a person is depicted in FIG. **4**. A variable component is produced when the person obscures - with fingers, for example - one or more of retro-reflecting parts **81**, **82**, and **83**. A fixed component comprises a set of retro-reflecting parts **85**.

A retro reflector can be attached to a persons gear - head gear for example - so that positions of the person can be imaged from above to identify the person and trace the positions. An information system can attach an identifying label to a displayed image of the person. When many persons are so imaged, only selected traces can be displayed and can be color coded. Paths of players in a sporting event can be traced.

A retro reflector can be attached to a first aircraft transporting a person so that a light source and imager on a second aircraft can detect the presence and motion of the first aircraft.

In as much as a finger tip reflects light from the light source back to the

5   imager with a signal to noise ratio greater than one, the finger tip - **31A** depicted in FIG. **5** for example - can be used in place of the retro reflector **31** though a poor signal to noise ratio will burden the imager. While finger tip properties - such as color - can provide the fixed component, this would further burden an imager. A fixed component - such as the retro-reflecting stripes **85A** around a

10   cylinder shown in FIG. **5** - burdens the imager less.

The signal to noise ratio provided by a retro reflector can be increased. For example, a retro reflector can reflect a first electromagnetic radiation spectrum portion greater than other electromagnetic radiation spectrum portions, and the imager can be more sensitive to the first electromagnetic radiation

15   spectrum portion than to other electromagnetic radiation spectrum portions.

Also, the light source can be modulated at a first frequency and the imager can be more sensitive to light modulated at the first frequency than to light modulated at other frequencies. With a modulated light source the distance between a retro reflector and the imager can be determined by time of flight

20   measurement.

A scanner can be added. The scanner can be an imager scanner scanning the imager over a light source illuminated; can be a light scanner scanning the light source over an imager viewed solid angle; and can be a combined scanner scanning the imager and the light source together over a solid angle.

5   Combinations of all the several signal to noise ratio improvement methods can be used.

Information processing capacity needed to detect the retro reflectors and generate inputted data can be incorporated in the imager itself so that the imager can input data to the information system in forms similar to forms provided by

10   keystrokes and mouse devices. Information processing capacity of the information system can be used to detect retro reflectors and generate inputted data, in which case the information system is part of the imager while it is helping generate input data.

Variations of the variable component - such as range and speed of motion

15   and relative configurations and motions of retro reflector parts - can be defined to execute members of a roster of signal components similarly to defining keystroke combinations.

The apparatus can be utilized interactively. For example, in response to a query communicated by the information system, a plurality of persons can input

20   responses. Also, for each of a plurality of persons navigating a territory, the information system can communicate to each of the persons a person specific

path from the location of each of the persons to a part of the territory sought by each of the persons.

The data processor can locate the retro reflector relative to a target object. The target object position can be determined by another retro reflector data input

5　apparatus. The target object could be a game animal and this would enable realistic bloodless hunting. The target object could be another person and this would enable bloodless combat training and sport.

Other equivalent forms for the imager, the light source, the retro reflector, the fixed component, the variable component, the identity signal, and the signal;

10　and other equivalent ways of using a retro reflector to input data to an information system will be obvious hereafter to persons skilled in the art. Therefore this invention is not limited to the particular examples shown and described here.

CLAIMS

What is claimed is:

1. Data input apparatus used with an information system, the data input

apparatus comprising:

5   an imager;

a light source adjacent to the imager;

a retro reflector, the retro reflector being connected to a person;

retro-reflected light, the retro reflected light being light from the light

source which is retro-reflected by the retro reflector to the imager,

10   the retro-reflected light having a fixed component, and the retro-

reflected light having a variable component varied by the person;

an identity signal, the identity signal being input to the information

system by the imager when the fixed component is detected by the

imager in a time interval; and

15   a signal, the signal being input to the information system by the imager

when the variable component is detected by the imager in the time

interval.

2. The apparatus of claim 1 further comprising:

a sequent retro reflector, the sequent retro reflector being connected to a

sequent person;

sequent retro-reflected light, the sequent retro reflected light being light

5   from the light source which is retro-reflected by the sequent retro

reflector to the imager, the sequent retro-reflected light having a

sequent fixed component, and the sequent retro-reflected light

having a sequent variable component varied by the sequent person;

a sequent identity signal, the sequent identity signal being input to the

10   information system by the imager when the sequent fixed

component is detected by the imager in the time interval;

a sequent signal, the sequent signal being input to the information system

by the imager when the sequent variable component is detected by

the imager in the time interval.

15   **3.** The apparatus of claim 1 wherein the retro reflector reflects a first

electromagnetic radiation spectrum portion greater than other electromagnetic

radiation spectrum portions and the imager is more sensitive to the first

electromagnetic radiation spectrum portion than to the other electromagnetic

radiation spectrum portions.

4. The apparatus of claim **1** wherein the light source is modulated at a first frequency and the imager is more sensitive to light modulated at the first frequency than to light modulated at other frequencies.

5. The apparatus of claim **1** further comprising a scanner chosen from the group consisting of:

an imager scanner scanning the imager over a light source illuminated solid angle;

a light scanner scanning the light source over an imager viewed solid angle; and

a combined scanner scanning the imager and the light source together over a solid angle.

6. The apparatus of claim **1** wherein the retro reflector is on a hand portion of the person.

7. The apparatus of claim **1** wherein the retro reflector is on an object held by the person.

8. The apparatus of claim **1** wherein the retro reflector is on gear worn by the person.

9. The apparatus of claim **1** wherein the retro reflector is on a vehicle transporting the person.

10. Data input apparatus used with an information system, the data input apparatus comprising:

an imager;

a light source adjacent to the imager;

5   a retro reflector, the retro reflector being connected to a person;

retro-reflected light, the retro reflected light being light from the light

source which is retro-reflected by the retro reflector to the imager,

the retro-reflected light having a fixed component, and the retro-

reflected light having a variable component varied by the person;

10   an identity signal, the identity signal being input to the information

system by the imager when the fixed component is detected by the

imager in a time interval;

a signal, the signal being input to the information system by the imager

when the variable component is detected by the imager in the time

15   interval;

a sequent retro reflector, the sequent retro reflector being connected to a

sequent person;

sequent retro-reflected light, the sequent retro reflected light being light

from the light source which is retro-reflected by the sequent retro

20   reflector to the imager, the sequent retro-reflected light having a

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sequent fixed component, and the sequent retro-reflected light

having a sequent variable component varied by the sequent person;

a sequent identity signal, the sequent identity signal being input to the

information system by the imager when the sequent fixed

component is detected by the imager in the time interval; and

a sequent signal, the sequent signal being input to the information system

by the imager when the sequent variable component is detected by
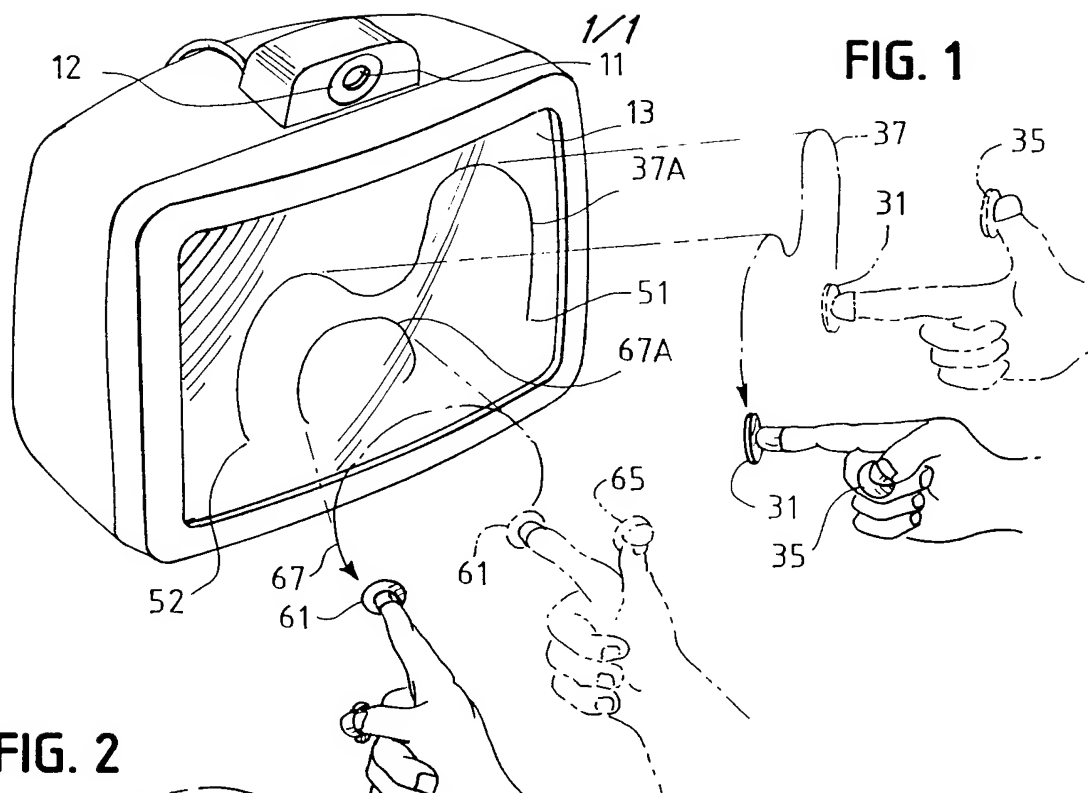
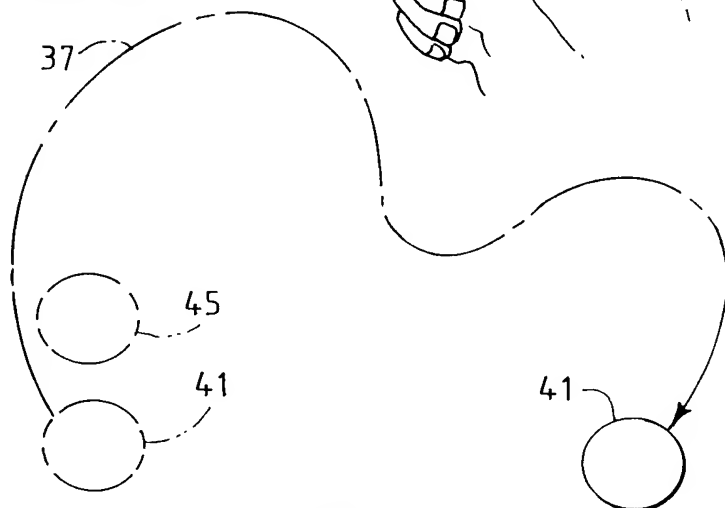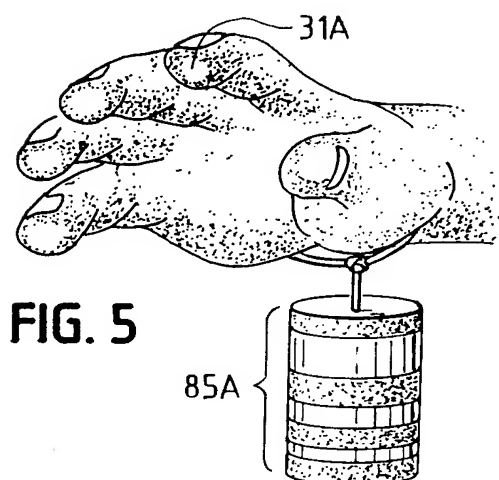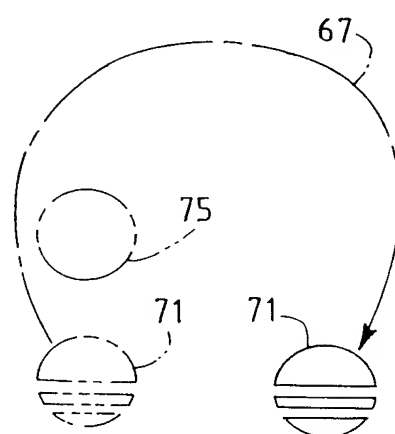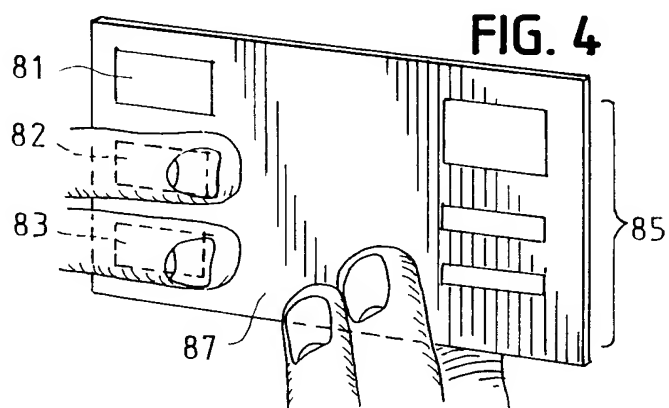the imager in the time interval.

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/07538

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G02B 5/12
US CL : 359/515, 516, 517, 520, 533; 116/209

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 359/169, 170, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 533; 116/209; 356/152.3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST
Search terms: imager, retroreflect, detect, (fixed component), (variable component)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---- A	US 4,053,233 A (BIEN et al) 11 October 1977 (11.10.1977), Figs. 3-4.	1, 3-5, 8-9 ---------- 2, 6-7, 10
X ----- A	US 4,099,050 A (SAUERMANN) 04 July 1978 (04.07.1978), Figs. 1-3 and the accomapying text.	1, 3-4, 7 ------------ 2, 6, 10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance		
"E"	earlier document published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 JUNE 2000	**11 July 2000 (11.07.00)**

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